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## **JOINT NATURE CONSERVATION COMMITTEE**

### **PROGRESS IN DEVELOPING A PROPOSAL FOR A TERRESTRIAL SURVEILLANCE STRATEGY**

*Improving the evidence base for measuring outcomes, guiding policy, predicting impacts, and reporting on priorities*

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#### **1. Background**

- 1.1 In 2006, JNCC proposed a '*UK Strategy for surveillance, reporting and research for nature conservation*'<sup>1</sup> (JNCC 06 D020). The ideas were widely consulted on. This document takes the comments into account and develops the surveillance part of the original strategy proposal. Surveillance is used throughout as a short hand for surveillance or monitoring. Both comprise repeat sampling of biodiversity, and practitioners variably label their sampling activities monitoring or surveillance.
- 1.2 The scope of this proposal is for surveillance that can provide evidence relevant to the biodiversity strategies of the countries and the UK, and its subject is land and freshwater (terrestrial) biodiversity. The strategy for marine biodiversity surveillance is being developed separately from this proposal, but as an integral part of the UK Marine Monitoring and Assessment Strategy process.
- 1.3 The draft strategy is designed to contribute to the co-ordination of surveillance at the scale of the environment i.e. across air, water, waste, land use etc. The Environmental Research Funders Forum (ERFF) has established a project board to deliver a joined up environmental monitoring strategy - currently proposed as an 'Environmental Observation Framework'.
- 1.4 The strategy proposed here is designed to become the biodiversity component of the Environmental Observation Framework. The Framework will help users of biodiversity surveillance gain access to the sampling of variables (e.g. temperature, chemicals, land use change) that are needed to interpret the signal from biodiversity sampling. Another gain will be the ability to form partnerships with other sectors for analysis and modelling, and to spot synergies that will influence sampling design/cost, for example by integrating

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<sup>1</sup> <http://www.jncc.gov.uk/pdf/comm06D02.pdf>

sampling into schemes that measure biodiversity and other environmental variables.

- 1.5 In this paper, the term 'sampling' is used to mean a scheme of surveillance. This strategy proposal is for the many current investors, providers, and users of biodiversity sampling, and intends to provide ideas on how they might collaborate most effectively to achieve the objectives suggested by the strategy. The ultimate aim would be a stakeholder-owned strategy, but the immediate aim is a coherent proposal to allow stakeholders to judge the value of having a strategy, and help them decide how they would like to refine and then implement it.

## 2. Purpose and value

- 2.1 The purpose of the strategy is to evolve a flexible core of sampling schemes that collectively meet the sampling-based evidence needs of biodiversity strategies, and that allows new needs for evidence to be integrated by adjustment or supplement, rather than creating separate solutions for each new requirement.
- 2.2 The aim is for the strategy to have a long shelf life, providing a mechanism for adjusting surveillance as needs change. However it can be used now to identify priorities for public and other stakeholder investment or adjustment. A rapid analysis of gaps and overlaps against the objectives has been undertaken, and recommendations made.
- 2.3 All stakeholders in biodiversity surveillance are working to deliver biodiversity outcomes on constrained resources. The real gain of a strategy for surveillance is if it helps balance the many needs for sampling so that the whole sector can achieve the most benefit from limited funds.

## 3. Introduction

- 3.1 The challenges for delivering biodiversity as a component of healthy and functioning ecosystems include:
  - i. measuring progress in creating ecological networks and achieving habitat quality and maintaining species diversity;
  - ii. anticipating the effect on biodiversity of policy proposals, economic or other environmental change;
  - iii. identifying the changes in biodiversity that need to be addressed;
  - iv. understanding the drivers of these changes;
  - vi. developing responses to maintain biodiversity that are cost-effective to employ.

- 3.2 Surveillance is a fundamental tool for providing evidence to help with these challenges as it is, through its long-term nature, very effective at picking out significant change in biodiversity from the background of natural fluctuations. It is also the starting point for understanding the reasons for change through correlation with other variables, and through knowledge of the different ecological requirements of the biodiversity being sampled. Finally, it has a role in prediction. It provides a rich source of data to calibrate the relationships between biodiversity and the environment in order to feed the modelling needed for prediction.
- 3.3 Ensuring that long-term sampling fulfils these functions effectively requires careful, fit-for-purpose design. Long-term sampling has a long lead time (6+ years) before it is useful, but, once established, can remain valuable for decades. The key to its value is far-sighted planning that takes into account current needs, but makes sure sampling will pick up changes to biodiversity under a wide range of future scenarios of land management and variations in environmental parameters. The aim of the planning is to produce a flexible suite of sampling that provides the first cut of evidence for most policy questions when they occur. Similarly, having a suite of sampling in place should mean that indicators can be drawn out of the sampling when they are needed to illustrate the drivers for policy, and show progress against targets. Value for money is achieved through the re-use of the same suite of sampling to provide evidence for a wide range of policy questions, rather than commissioning separate solutions for each policy question as they occur.
- 3.4 There is a significant body of long term biodiversity sampling underway involving public bodies, Non-Governmental Organisations (NGOs) and some private industry <sup>2</sup>. The annual equivalent spend is roughly £7.08<sup>3</sup> million compared to an overall conservation spend of [X]. Much of the actual sampling is undertaken by volunteers, and the annual value of their contribution to biodiversity sampling is approximately £16 million. All of the sampling is delivering at least some support to conservation relevant objectives, but use of the results has shown that there are persistent gaps in coverage<sup>4</sup>. There has not, to date, been a chance to consider how the sampling currently in place delivers an overall detection mechanism for biodiversity in the UK environment.
- 3.5 This strategy identifies three key objectives for surveillance. It proposes an adaptive mechanism for determining which current sampling provides the strongest support to these objectives, and for finding out what changes or

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<sup>2</sup> Work to devise the strategy has catalogued a summary picture of the sampling already underway showing that there are circa 70 separate sampling schemes underway. The catalogue is available as a spreadsheet from JNCC <insert link> and its content has been synchronised with the ERFF environmental monitoring scheme database. Biodiversity is not a simple single to measure parameter like say, aspects of air quality, and different components of biodiversity often require different sampling methods, hence the number of schemes in place.

<sup>3</sup> Provisional estimates of total annual spend on biodiversity surveillance, and the value of the volunteer effort are based on the analysis done for the BRIG in November. These estimates will change as the community validate the spreadsheet of sampling activity.

<sup>4</sup> Gaps in coverage include gaps in knowing what is happening to biodiversity in some areas of the UK; gaps in knowing what is happening to many habitats, gaps in evidence for the impacts of major pressures, gaps in knowing the status of many priority species and habitats.

additions would improve the value of the evidence available. The mechanism proposed would also highlight ways to make cost-effective changes in sampling, and help the stakeholders adjust their sampling activities or investments to contribute.

#### 4. Users of the Strategy

- 4.1 The strategy is to help the country and UK stakeholders in surveillance and monitoring (policy makers, operational agencies, NGOs, providers of sampling, volunteers) meet their specific objectives within a joined-up cost-effective suite of long-term sampling activities that, collectively, deliver against the strategy objectives.
- 4.2 Policy makers are not direct users of sampling or engaged with the detail of the strategy for it. However, if the strategy is working well they would find that evidence derived from sampling under the strategy was relevant to their questions through time. In addition, the strategy should respond to reviews of the evidence needs for their policies, and adjust the suite of sampling as necessary. The main gain of the strategy to policy makers is its focus on sampling that will pick up the interactions between biodiversity and the pressures on the environment. This will ensure that there is evidence relevant to the challenges of using the environment sustainably.
- 4.3 Agencies and NGOs can use the strategy as a tool for deciding where to make the most of their own investments in sampling to meet their priority needs. They should be able to use the strategy to identify the coverage of existing sampling; what it is delivering; the opportunities for synergy; and the outstanding gaps in coverage. The main gains are helping ensure value for money, increased possibilities for partnership or multipurpose solutions, and being able to add sampling that contributes most to the overall picture, or stop or re-direct sampling that contributes least.
- 4.4 The many individual schemes will benefit from increased cross-cutting analysis of sampling to meet evidence needs, and hence a greater user base for their sampling. The strategy should also provide a better picture of user needs, and so, if schemes choose, they can adjust their sampling to contribute.
- 4.5 The aim of the strategy is to get better coverage for the limited public, NGO and volunteer time resources available. It does not intend to prohibit voluntary sampling that can add to the objectives, but which may not be essential given the other sampling already in place. However, it should serve to guide public investment into areas of most need.

#### 5. Objectives

- 5.1 This is a strategy to improve the value of the evidence provided by the long term sampling of biodiversity (genes, species, habitats and ecosystems) by evolving a flexible core set of sampling schemes to meet three objectives.
- 5.2 ***Objective 1 - measuring the overall state of UK biodiversity in relation to the outcomes required by UK and country biodiversity strategies. This is in order to identify problems, measure policy effectiveness, and enable priorities to be established for future action.***

- 5.3 **Objective 2 - detecting the impacts of the pressures affecting biodiversity through interpreting changes in biodiversity status. This is in order to provide evidence to support policies/actions to mitigate the pressures, or tackle their drivers.**
- 5.4 **Objective 3 - assessing the status of the wide range of species and habitats covered by the sum of the policy, legislative and international conservation commitments. This is so as to comply with these obligations.**
- 5.5 Objectives 1-3 are hierarchical. Objective 1 establishes the main surveillance needs by measuring key components of biodiversity state; Objective 2 determines how much the sampling in place for Objective 1 can help provide evidence for policy/action to mitigate pressures, and determines what supplementary sampling is needed. Objective 3 looks at the legislative and policy commitments for biodiversity conservation, determines their sampling needs, how much they are met by sampling in place for Objectives 1 and 2, or, if not, what supplementary surveillance is needed.
6. **Current contribution of sampling to the objectives; the gaps and the future direction**
- 6.1 Most of the current set of 70 surveillance or monitoring schemes include sampling relevant to the scope of the strategy. A rapid review has been undertaken in order to determine how well these schemes, collectively, meet the needs of the objectives. The review identifies the sampling requirements of each objective and then determines the current cover from existing sampling. The next step is to identify the key gaps and overlaps, and finally consider potential solutions.
- 6.2 A summary of this rapid review is provided below.
- 6.3 **Objective 1** - measuring the overall state of UK biodiversity; in relation to the outcomes require in the UK and country biodiversity strategies, in order to identify problems, measure policy effectiveness, and so inform the priorities for future action.

*Analysis of the objective*

- 6.4 The biodiversity outcome which country and UK biodiversity strategies are working towards is in essence, a) to maintain, create, and restore functional combinations of habitats that will provide ecosystem services and reduce the vulnerability of isolated habitats and species populations, b) within these ecological networks to make sites more robust to environmental change by improving their quality and condition, and to reducing the impact of other pressures in the surrounding areas, and c) to, first, halt the decline of species diversity, and then maintain it, allowing for climate adaptation.

### *Sampling Requirement*

- 6.5 To determine if this outcome is being achieved, the requirement is for, a) representative sampling of semi natural habitat pattern and conversion rates, b) within habitats, representative sampling of structural, functional and species composition measures of quality, and c) to sample widespread species dependant on different landscape scales from micro-habitat to migratory.

### *Current coverage*

- 6.6 Coverage is fragmentary for habitats and moderate for species. Habitat pattern and conversion rates are available from Countryside Survey for some landscape features e.g. hedges. Habitat mapping so far as produced one off local and a few wider habitat inventories, whilst Land Cover Mapping provides some measure of broad habitat heterogeneity, but not for most semi-natural habitat. Site Condition Monitoring provides some coverage depending on the proportion of total habitat with the SSSI series, and in England some habitats have had recent stratified surveys, which could be repeated. For species, sampling of widespread breeding birds provide country level trends for the UK, in England, Scotland and Wales. Sampling of butterflies, some moths and mammals adds information at UK, England, and Scotland levels. For vascular plants, lichens, bryophytes and a good selection of invertebrate taxa, measures of change are available but on much longer time periods e.g. 20-40 years and mainly only at the UK level.

### *Gap/overlaps*

- 6.7 The main habitat sampling gaps are a repeatable means of measuring habitats at the landscape scale (area, patch-size, pattern, conversion rates) and repeated representative sampling within each habitat type. The main species sampling gaps are: sensitive (in time) sampling of a more balanced set (by trophic level/function) of species; improving the ability of sampling to provide England, Scotland, Wales, Northern Ireland level information; and the coverage of uplands and possibly freshwaters. The main overlaps are that local site, agri-environment and SSSI sampling together visit a significant proportion of habitat but don't collectively provide a representative picture of change.

### *Direction*

- 6.8 To establish whether new methods of processing remote sensing data can be used to determine landscape measures of habitat change. To investigate the feasibility of stratified sampling of semi natural habitat within each broad habitat, and the fit of this with other sampling frameworks e.g. National Inventory of Woodlands and Trees, Countryside Survey and Common Standards Monitoring. For species, the direction is to see if the country and upland level coverage issues can be overcome, and to improve coverage of species at lower trophic levels/depending on micro habitats.

- 6.9 **Objective 2** - detecting the impacts of the pressures affecting biodiversity through interpreting changes in biodiversity status, in order to provide evidence to support policies/actions to mitigate the pressures, or tackle their drivers.

*Analysis of the objective*

- 6.10 Objective 2 uses the Millennium Ecosystem Approach categories for the main pressures affecting biodiversity: habitat transformation, exploitation, non natives, climate change, pollution. To help deliver Objective 2, sampling needs to provide feedback into climate adaptation measures, help with early detection and response for non natives, show whether diffuse pollutants are having an impact, assist with biodiversity risk-assessment of approved chemicals, help determine the social/economic drivers of habitat change, and help keep hunting/harvesting of biodiversity at sustainable levels.

*Sampling Requirement*

- 6.11 For habitat transformation and climate change, improving Objective 1 sampling is key. It will detect change in habitats, measure the adaptation policy of establishing ecologically resilient networks, and provide actual rather than predicted change in species distribution due to climate space shift. For non-natives, the requirement is for wide taxonomic cover, and, where relevant, targeting around likely pathways. For pollutants the requirement depends on the level of proof needed that they are affecting biodiversity objectives. For the small number of directly exploited species, the requirement is for population trends.

*Current coverage*

- 6.12 Land use and agricultural data are successfully used to help interpret existing habitat/vegetation change data, and climate variables are also available to correlate with existing biodiversity sampling. The large (mostly volunteer) sampling effort for many taxonomic groups does pick up non natives early, and population trends are available for directly harvested or hunted vertebrates. Bio-indicators are available for some diffuse pollutants, e.g. Ellenburg values, and research-scale sampling is in place to pick out pollutant from other effects, i.e. Environmental Change Network. Species sampling covers the top of the food chain species, and so should pick up impacts of bio-accumulative pollutants.

*Gaps/overlaps*

- 6.13 The habitat gaps identified for Objective 1 are also gaps for Objective 2, particularly for climate change, which will also trigger change in management and land use. The main gap with non-natives is the rapid reporting of non-natives once detected and the associated process to act on the information. Both climate change and non-natives would benefit from much better access to biodiversity data across Europe. For pollutants, supplementary sampling may be required once the level of proof needed by policy is better understood.

The approved chemicals risk-assessment process is not yet in place, and there is declining support for tissue banks that provide one of its sources of information.

#### *Direction*

- 6.14 The priority is to strengthen the direction set for Objective 1 to provide better data for interpretation with other non-biodiversity datasets. The mechanisms that support voluntary recording of a wide range of groups need to be strengthened to help report non-natives early, and, where relevant, target sampling. More effort needs to be put into determining the evidence needs for policy on pollution and determining the best sampling approaches. Building on the establishing sampling networks, and on data access mechanisms like Global Biodiversity Information Facility, we need to see if the UK can be influential in creating access to comparable data across Europe.
- 6.15 **Objective 3** - assessing the status of the wide range of species and habitats covered by the sum of policy, legislative and international conservation commitments.

#### *Analysis of the objective*

- 6.16 Objective 3 looks at the legislative and policy commitments for biodiversity conservation, determines their sampling needs, how much they are met by sampling in place for Objectives 1 and 2, or, if not, what supplementary surveillance is needed. Commitments largely focus on species or habitats that have undergone significant decline, or are vulnerable due to small population size or limited distribution. Ideally, in the long-term, sampling for Objectives 1 and 2 would provide the evidence for action that prevented species or habitats reaching this state. In practice, it will take considerable time to restore some legislative/policy species and habitats to the state that they are viable, and sampling can help target action and provide measures of progress;

#### *Sampling Requirement*

- 6.17 The Habitats and Species Directive places, through its national translations into law, a legal requirement for sampling to determine the favourable status of its listed species and habitats. For the Biodiversity Action Plan priority species, the requirement is for sampling where this helps decide on action, and, ultimately, to measure achievement of the outcome-based success criteria for each. [Birds Directive not summarised yet]. The Wildlife and Countryside Act schedules are about stopping direct human exploitation e.g. egg collecting, removal of wild plants for horticulture, disturbance. Sampling of biodiversity also has a role in considering whether species should be on/off the schedules, as this provides evidence as to whether exploitation is likely to lead to the species becoming endangered;

*Current coverage*

6.18 Status and trend information evidence is available for nearly all bird and butterfly and some mammal commitment species and generally is sensitive to the 6 year reporting cycle required by the Habitats Directive. Longer time period (15-40 years) data are available for many of the other commitment species. [put in the numbers covered for BAP and Habitat Directive species from the more detailed papers]. The listed habitats have partial cover by sampling from Common Standards Monitoring and Countryside Survey;

*Gaps/Overlaps*

6.19 The most pressing gaps are for sampling that helps assess the status of Habitats Directive listed habitats and UK BAP priority habitats which emphasises the need for effective habitat sampling for Objective 1. For a significant proportion of BAP species, there is a gap in being able to determine whether the range/population success criteria for each are met, and an even bigger gap if the targets really have to be measured in every 3-5 year reporting cycle. However, a smaller proportion of species would benefit from targeted survey to help determine the best course of action.

*Direction*

6.20 The priority is to strengthen the direction set for habitat sampling under Objective 1, but making sure it is possible to infer the status of the Habitats Directive habitat types from the sampling put in place. For the BAP, for many species, e.g. plants, lichens, bryophytes, many invertebrates, the demand for sampling could easily outstrip the expert, largely volunteer, community able to undertake it, and it could also divert too much of this expertise into sampling and not enough into helping influence the habitat and other plans needed to address the needs of the species. The suggested direction is to reinforce the ability of the available recording effort to target resources where sampling would have the most benefit in delivering action and to help collate and make the data available.

**7. Recommendations for early implementation**

7.1 In section 6, the main sampling requirements of the three strategy objectives are proposed, and the results of a rapid analysis by JNCC is shown. It also provides a picture of current coverage against the requirements, and of the gaps and overlaps this reveals.

7.2 If the stakeholder community adopts the strategy, the process of agreeing requirements and determining solutions will need to become a multi-stakeholder process. The analysis of requirements and modelling solutions given existing sampling will take time and will need to be repeated as circumstances change in the longer term.

7.3 Given the urgent need for advice on how to meet BAP and Habitats Directive needs, and on fitting sampling to the biodiversity strategies, JNCC has made

some recommendations based on the rapid analysis undertaken so far. These recommendations are, in JNCC's opinion, important to address early and they cover gaps that any multi-stakeholder process is likely to identify. By providing recommendations, JNCC hopes it will help the community judge the value of having a strategy.

### ***Recommendations***

- 7.4 Improve the means of measuring whether current habitat surveillance strategies are maintaining and enhancing functional combinations of habitats in the landscape. In particular, test whether advances in processing aerial and satellite remote sensing data can provide a repeatable means of mapping and measuring change in area, distribution, combination, of relevant levels of semi-natural habitat, in time to influence the next generation of habitat inventory and land cover mapping investments.
- 7.5 Provide a means to assess how and why the quality of habitats is changing overall, whilst meeting specific needs for SSSI condition, BAP, Habitats and Species Directive, and the Water Framework Directive. In particular:
  - i. establish the feasibility of using a representative, sample-based approach within broad habitats for determining semi-natural habitat quality, by deploying repeatable measurements of vegetation, structure, function, and considering stratification to meet SSSI, and incentive scheme needs;
  - ii. investigate rapid techniques for assessing habitat quality/condition for use to determine condition more generally.
- 7.6 Improve the upland and country-level cover of selected species sampling to provide an independent check that our habitat based measures are sustaining species in the landscape, and to improve feedback into climate change adaptation. In particular, investigate whether collaboration between schemes and between schemes and agencies can devise cost effective ways of providing the cover.
- 7.7 Consolidate and enhance mechanisms that help volunteers undertake targeted sampling of plants, bryophytes, lichens and invertebrates, in order to deliver early detection of non-natives, provide sampling to assist habitat based action for BAP species, and assess relevant SSSI species features.
- 7.8 Consider how best to encourage the accessibility of biodiversity data across Europe, and the growth of compatible monitoring, without increasing the reporting burden, in order to improve analysis of climate change impacts and assist with non native detection and risk assessment.
- 7.9 Determine the level of proof that diffuse pollutants are impacting on biodiversity objectives in order to devise the best enhancement to sampling. In particular, review existing evidence use and options for enhancing it with policy leads.

- 7.10 Determine whether it is feasible to run a risk assessment process to identify the approved chemicals that are likely to cause significant biodiversity impacts.

**8. Implementation approach - dealing with migration**

- 8.1 The key to implementing the strategy is to work alongside existing surveillance schemes when they are being reviewed, or new schemes in development, to identify how they can be adjusted to fit more closely with strategy objectives.
- 8.2 The recommendations made in section 7 are mainly investigative tasks aimed at providing credible options before major review milestones arise in existing major schemes.
- 8.3 The surveillance strategy is effectively a long-term mechanism for adjusting sampling to fit the current biodiversity strategy better, and to allow further modifications, as needs change.
- 8.4 To provide a change mechanism, the strategy periodically needs to revisit one or more of the following steps:
- i. update the overview of sampling activity, and encourage stakeholders to use it as a starting point for devising solutions to meet their needs;
  - ii. work with data owners, and through the Environmental Research Funders Forum, to establish open access to surveillance/monitoring data sets, to encourage their re-use in meeting multiple needs, or in multi disciplinary analysis;
  - iii. check the objectives and refine their requirements. Model desired sampling using current best practice in sampling design, and compare against available sampling. Identify options for change;
  - iv. identify scientific or technological change that could make alternative ways of meeting the requirements viable, or that could reduce cost. Raise awareness and encourage adoption;
  - v. encourage adoption of evidence-based policy best practice - in particular, for new evidence needs, encourage cross-cutting analysis of existing sampling to determine how much it can contribute to evidence requirement, refine ideas on the quality and type of evidence needed, and help identify where the priority gaps are.